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Heinz Rath
STS Safety Technology Systems

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The MineWolf Toolbox System: Ground Preparation to Mine Clearance

The MineWolf Toolbox System, which operates in minefields near Sarajevo, is a mine clearance device that has been used to improve efficiency and effectiveness in demining operations. This article discusses the benefits of the MineWolf Toolbox System and compares it to other demining machines and technology currently used to clear minefields.

by **Heinz Rath, Project Manager, STS**

Introduction

MineWolf is a joint German-Swiss mine clearance concept developed through the collaboration of an industrial machinery manufacturer based in Herdswangen, Germany (the AHWI), RUAG Land Systems, based in Thun, Switzerland, and the Safety Technology System (STS) in Germany. In our detailed discussions with the Mine Action Centre (MAC) in Bosnia and Herzegovina (BiH) as well as in Croatia, we learned that the emphasis of future demining activities is on the large areas of minefields and suspected fields. Croatia has 1,630 sq km with approximately 700,000 mines and items of UXO, and BiH has 2,000 sq km of suspected areas. The ratio of suspected fields to mined fields is about 10:1. Obviously, demining these areas is a challenge that can only be met with the use of improved mechanical demining machines (in terms of cost and time). We asked the users, the MACs and the non-governmental organizations (NGOs) whether today's technology met their requirements, and have come to the conclusion that today's tiller or flail machines need to be improved.

Performance Comparison of Today's Mechanical Demining Systems

The present tiller systems are too heavy (up to 55 tons), too large in size (tank

size) and too expensive, with high operational costs and limited mobility. The high operational costs are the result of AT mine blasts that occur next to the tiller, which lead to damage to both the tiller and the machine. The flail system avoids the disadvantages of high weight and cost. AT mines explode far in front of the machine, and the blast can expand through the chains, resulting in a reduced impact on the machine. In addition, the ground-beating equipment is easy to replace if damaged. However, the flail machine suffers from limited demining depth, problems with

vegetation and the need for intensive quality assurance (QA) with manual/dog demining.

The MineWolf System

Clearance Methodology

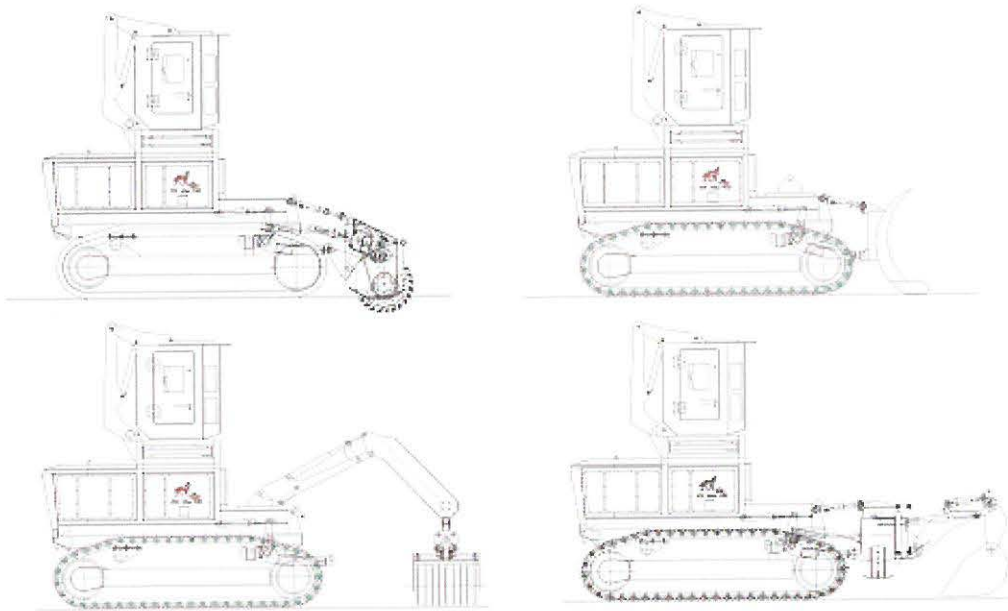
Clearance of mixed AP/AT minefields is divided into two phases. First, the flail system detonates or breaks up the AP and AT mines. Then, with a ground penetration depth of 30 cm, the tiller system breaks up the remaining intact mines and reduces the size of components left by the flail.

Description of MineWolf Technology

MineWolf Technology combines the strengths of the flail and tiller systems to create a more efficient and effective demining system. The following list describes some of the important characteristics of the MineWolf System.



The MineWolf System.



The MineWolf is a multi-purpose part of the demining toolbox.

- A medium-sized Standard Crawler Tractor can be used with a Deutz-Diesel engine of 300 kW with a pendulum track.
- The power transmission is provided mechanically by a heavy duty PTO shaft via a turbo clutch to provide protection of the driveline.
- The use of quick couplings facilitates rapid replacement of the demining tools (within 15 minutes).
- The open Basket-Type Tiller design allows expansion of the mine blast through the tiller to avoid or reduce damage.
- The MineWolf is equipped with a Leica GPS-System 500 for directional control.
- Depth control is provided for flail and tiller operation.
- The total weight does not exceed 20 tons (excluding tools).
- The system is designed for container transport by road, rail, sea or air.
- The MineWolf is a multi-purpose toolbox machine. With standard commercial attachment, it can also be used for construction, agriculture and forestry.
- The MineWolf can be operated by local personnel.

Specifications for the Use of Mechanical Demining Machines in BiH for Survey Areas

The Bosnia and Herzegovina Mine Action Centre (BHMAC) has released the standard operating procedure book, SOP-14. In chapter four, on page 3/16, the specification reads as follows:

"The basic Bosnia and Herzegovina Standard layout for a machine is as follows: machine with technical and other characteristics proved through testing, which is capable of removing vegetation and disturbing the soil to the minimum of 10 cm into the depth, breaking it to pieces not larger than five cm in diameter, presents the adequate quality that is achieved by using the prodder (minimum 10 cm in depth), or the detector, which is supposed to locate the minimum metal content mine to 10 cm into the depth (PMA-3). Provided these characteristics might be used at suspect areas for which there is no reliable data on mining, the BH Standard in Chapter XIV-Mechanical Preparation of the Ground

proposes these areas (entire or partially) be declared as areas without obvious risk, provided there were no explosions or visible mines thrown out on the surface or their parts. Such areas would not be further threatened, while the demining resources might be deployed at other mined areas."

Flail machines, as used today, do not meet these requirements and are therefore only to be used as ground preparation machines. The MineWolf, with its rough (flail) and fine (tiller) operation, has the potential to meet the specifications and may be considered for survey operation as a mine-clearing machine. The MineWolf can be used as a mechanical detection system to mark the edges of the minefield and thus achieve area reduction.

Experience has proven that during demining mines can be destroyed without exploding; AP and AT mines with plastic cases can burst into pieces but not explode. Fuses and pieces of TNT may still be left. PROMS with steel bodies also might not be completely destroyed. The partially destroyed mines remain as a residual risk. In the discussion about the danger of these residues, the following proposals should be considered:

- No further treatment providing SOP-14 (area without obvious risk) will be met.
- The UN requirement of 99.6 percent must be fulfilled.
- Repeated tiller operation to break up remaining mine parts into smaller pieces should take place.
- Visual control should occur by explosive ordnance disposal (EOD). If mine parts are found, 100 percent man/dog survey is necessary in the surrounding five-meter area.
- Survey with EOD and mine dog should be conducted. The burst mine should be found due to the intensive smell of TNT.
- Survey with an array metal detector mounted directly behind the MineWolf, with colour marking or global positioning system (GPS) identification. With this method, pieces of UXO can be found.

All these methods would drastically reduce time and cost compared with today's practise of 100 percent survey with man/dog on survey fields.

Specifications for the Use of Mechanical Demining Machines on Mined Areas in BiH

Areas declared as minefields based on survey Level 1 to Level 3 require a 100 percent quality control with man/dog teams after the mechanical demining process, as machines used today are ground preparation machines only. It is basic knowledge in the car and aircraft industry that quality cannot be inspected—quality has to be guaranteed by the process. MineWolf improves the quality of the demining process compared to flail machines in the following ways:

- Two demining operations (flail = rough; tiller = fine)
- Ground penetration depth of 30 cm
- Multiple operations with the tiller (if required)
- Breakup of partially exploded or remaining mines and explosive components not completely destroyed by the flail
- GPS navigation for directional control
- Depth control for flail and tiller
- Improved vision with optimal position of driver cabin
- Drive-control system for operator
- Control of all relevant technical data, such as penetration depth, speed of flail and tiller, vehicle speed, etc.
- Quality control with array metal detection system mounted on the back of the vehicle
- Failure Mode and Effect Analysis (FMEA) for machine and process



Tests on the MineWolf helped determine that the flail unit is designed for venting large explosive blasts.

Functional Testing by BWB (German Army), RUAG (Tunnel Test) and ITEP (Flail System)

A functional prototype vehicle was tested by the German army at their test fields in Koblenz and Meppen. Ninety-five inert test mines, AP and AT mines of different types, were buried up to 30 cm deep at different ground conditions. The aim of the test was to measure clearance effectiveness. The German army came to the following conclusion: "All mines and mine parts detonated by the MineWolf have been destroyed leading to a minefield without danger."

Based on RUAG's broad expertise in testing armoured vehicles, we decided to test the protective features with a functional full-scale model in the test tunnel of the Swiss army. The test demonstrated that the MineWolf is protected against AP mines with up to two kg of TNT and against AT mines with up to 7.5 kg of TNT. The health risk of the driver was investigated by means of a dummy. The test proved that the tiller system and the mechanical power drive are very robust. The driver is safe under all conditions.

The International Test and Evaluation Program (ITEP) tested the flail system on a British army test field in Shoeburyness against AP and AT mines with up to 7.5 kg of TNT. (Based on an Armtrac 100 Tractor; Armtrac is the supplier of the flail system). The two AT-sized blasts provided useful information. The most significant conclusion is that the flail unit is well-designed for venting large explosive blasts.

Summary

Based on the positive test results, the MineWolf Toolbox System will lead to improvements over today's mechanical technology in the following areas:

- Demining effectiveness and quality of demining process
- Weight
- Transport and mobility
- Investment
- Operational costs
- Production time (the machine can be manufactured within four months)
- Ability to be used for multiple purposes in land preparation



The MineWolf clearing a minefield.

The MineWolf operates in minefields near Sarajevo from July until September, managed by the German humanitarian organisation HELP. The demining project is sponsored by the Department of Foreign Affairs of the Federal Republic of Germany.

*All photos courtesy of the author.

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Contact Information

Heinz Rath
Safety Technology System (STS)
Engineering/Consulting
Sebastian-Kneipp-Str.73a
D 56179 Vallendar
Germany
Tel: +49 261 6 679 628
Fax: +49 261 6 679 629
E-mail: h.rath@minewolf.com